OIPE
OCT 10 2003
PATENT & TRADEMARK OFFICE
RECEIVED
OCT 15 2003
TECHNOLOGY CENTER R3700

IN THE SPECIFICATION:

Please replace paragraph **[0001]** with the following.

[0001] The present invention relates generally to apparatus and to methods for conditioning pads that are used in ~~chemical mechanical~~chemical-mechanical polishing or chemical-mechanical planarization processes, both of which are referred to herein as "CMP" processes. Particularly, the present invention relates to apparatus and methods for conditioning CMP pads with little or no contamination of the pads. More particularly, the present invention relates to apparatus for conditioning CMP pads, as well as to methods that include use of the conditioning apparatus and removing contaminants left on the CMP pad by the conditioning apparatus following conditioning of a CMP pad.

A1

Please replace paragraph **[0030]** with the following.

[0030] As another example, abrasive particles 14 may be formed from iron (Fe) or an iron-containing material (*e.g.,* steel, or other iron-containing alloys such as INVAR®), copper, nickel, tungsten, or another suitable metal. A degradant or solvent for such abrasive particle 14 materials which does not substantially degrade ~~of~~ or dissolve the materials from which CMP pads are fabricated, may be used to remove any remaining abrasive particles 14 from a CMP pad. By way of example only, iron and iron-containing materials may be degraded or dissolved by hydrochloric acid, which does not substantially degrade or dissolve the materials, such as polyurethane, from which CMP pads are conventionally fabricated. As another example, nitric acid, phosphric acid, sulfuric acid, other acids, and acid mixtures may be used to degrade or dissolve abrasive particles 14 of other materials or oxides thereof. Additives, such as oxidants (*e.g.,* hydrogen peroxide (H_2O_2)), may also be used to facilitate the degradation and/or dissolution of abrasive particles 14.

A2

Please replace paragraph **[0032]** with the following.

[0032] As depicted in FIG. 1, supporting substrate 12 comprises a planar member embedded with abrasive particles 14. As shown, some abrasive particles 14 protrude from a conditioning surface 16 of supporting substrate 12. As abrasive particles 14 at conditioning

A3

surface 16 are worn down or break away from supporting substrate 12, conditioning surface 16 is preferably also worn, thereby exposing other abrasive particles 14 that are more deeply embedded within supporting substrate 12. Accordingly, supporting substrate 12 is preferably formed from a material that will wear during conditioning of a CMP pad when exposed to friction from the CMP pad or by the abrasion of abrasive particles 14 that break away from conditioner 10. For example, supporting substrate 12 may be formed from a polymer or combination of polymers that is as soft as or softer than the type of CMP pad to be conditioned with conditioner 10. Supporting substrate 12 is, preferably, also substantially rigid or ~~include~~ includes a rigid backing so as to impart planarity to a polishing surface of a CMP pad as the CMP pad is conditioned therewith.

Please replace paragraph **[0033]** with the following.

[0033] Conditioner 10 may be formed by dispersing a quantity of abrasive particles 14 in an at least partially unconsilidated (*e.g.*, molten, liquid, or particulate or powdered) quantity of material providing a matrix for supporting substrate 12. The mixture of supporting substrate 12 material and abrasive particles 14 is then formed into a solid mass. The desired shape for conditioner 10 may be obtained by use of known molding (*e.g.*, injection molding) or casting processes, as well as by cutting a larger, solid volume of abrasive particle 14-impregnated supporting substrate 12 material into the desired shape. A conditioning surface ~~16~~ 14 of supporting substrate 12 may be treated prior to use in conditioning so that abrasive particles 14 at least partially protrude therefrom. Of course, such treatment of conditioning surface 14 may be effected by removing material of supporting substrate 12 from conditioning surface 16. Such removal may be carried out by use of known chemicals or chemical mixtures (*e.g.*, hydrofluoric acid, potassium hydroxide, sodium hydroxide, hydrochloric acid, etc.) that will degrade or dissolve the material of supporting substrate 12 without substantially degrading or dissolving abrasive particles, or that at least degrade or dissolve the material of supporting substrate 12 at a faster rate than the rate at which the material or materials of abrasive particles 14 are degraded or dissolved by the chemicals. Alternatively, such removal may be effected mechanically, such as by frictional contact.

Please replace paragraph **[0038]** with the following.

[0038] As friction is created by movement of one or both of conditioner 10′ and CMP pad 20, abrasive particles 14 exposed to conditioning surface 16′ of conditioner 10′ abrade, or wear, polishing surface 22 of CMP pad 20, conditioning polishing surface 22 by providing same with desired characteristics, including, without limitation, texture, roughness, and planarity. The friction between conditioning surface 16′ of conditioner 10′ and polishing surface 22 of CMP pad 20, as well as the presence of abrasive particles 14 that have broken away from conditioner 10′, may cause conditioner 10′ to wear. If conditioner 10′ is at least partially impregnated below the ~~initially-exposed~~initially exposed layer of abrasive particles 14 with additional abrasive particles 14, abrasive particles 14 may continue to be exposed and, thus, to effect the conditioning process of the present invention as conditioner 10′ wears.

Please replace paragraph **[0045]** with the following.

[0045] As abrasive particles 14 (FIGs. 1-3) or debris 46 from filaments 44 (FIG. 5) or from abrasive elements 54 (FIG. 6) may be loosened from conditioner 10, 10′, 10″, 40 during use thereof to condition polishing surface 22 of CMP pad 20 (FIG. 4), abrasive particles 14 or debris 46 may stick to polishing surface 22 of CMP pad 20 or become embedded or entrapped within CMP pad 20, as shown in FIG. 7. These abrasive particles 14 or debris 46 may be substantially removed from CMP pad 20 at ~~hth~~ the conclusion of the conditioning operation by exposing CMP pad 20, along with abrasive particles 14 or debris 46, thereon to a chemical 80 or mixture of chemicals that will degrade or dissolve abrasive particles 14 or debris 46 at a faster rate than chemical 80 or a mixture of chemicals will degrade or dissolve the material or materials of CMP pad 20 and without significantly changing the surface features, texture, or roughness of polishing surface 22 of CMP pad 20. Preferably, chemical 80 or a mixture of chemicals that is used to remove abrasive particles 14 or debris 46 from CMP pad will do so without substantially degrading or dissolving the material or materials of CMP pad 20. As indicated previously herein, when abrasive particles 14 include quartz, or crystalline silicon dioxide, chemical 80 may include, without limitation, hydrofluoric acid, sodium hydroxide, or potassium hydroxide. If a

hydrofluoric acid solution is used, the hydrofluoric acid preferably makes up at least about 5% of the solution. If abrasive particles 14 or debris 46 comprise iron or an iron-containing material, chemical 80 may include, without limitation, hydrochloric acid.

Please replace paragraph **[0049]** with the following.

[0049] Once CMP pad 20 has been ~~conditioned,~~conditioned in accordance with the method of the present ~~invention,~~invention abrasive particles 14 or other debris 46 are removed from CMP pad 20 by exposing at least polishing surface 22 of CMP pad 20 to chemical 80. Accordingly, conditioning system 60 includes a chemical source 70 that is configured to apply chemical 80 to CMP pad 20. Chemical source 70 may be of any type known in the art and include, for example, an applicator, such as a spray head or a roller, for applying chemical 80 to CMP pad 20, or a chemical bath into which CMP pad 20 may be at least partially disposed.

Please replace paragraph **[0052]** with the following.

[0052] Referring again to FIG. 8, conditioning system 60 may also include a rinsing component 72 for disposing a rinse liquid 74, such as pure water, onto at least polishing surface 22 of CMP pad 20 so as to substantially remove chemical 80 therefrom.